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1. Untranslatable words are replaced with asterisks (****).
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FULL CONTENTS

[Claim(s)]

[Claim 1] Main minerals A 3 CaO-SiO₂-2 CaO-SiO₂-CaO-interstitial material, They are a 3 CaO-SiO₂-CaO-interstitial material, a 2 CaO-SiO₂-CaO-interstitial material, or a CaO-interstitial material. And the chemical admixture which consists of the clinker constituent which contains a CaO crystal 50 to 92weight %, the preferential grinding thing of gypsum fibrosum or said clinker constituent, quicklime, and a preferential grinding thing with gypsum fibrosum, Cement whose amount of weight loss from 20 degrees C by thermogravimetric measurement to 500 degrees C is 0.7 to 2.5 weight %, A water reducing agent, a fine aggregate, coarse aggregate, and high flow high-strength concrete whose total quantity of cement and a chemical admixture is characterized by 500-700kg/m³, and water / cement ratio being [a base-diameter-of-concrete-mass-after-the-slump-test value] 50-80cm at 25 to 35 weight % including water.

[Claim 2] High flow high-strength concrete according to claim 1 whose loadings of the above-mentioned chemical admixture are 1-60kg/m³.

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to high flow high-strength concrete with the small amount of autogeneous shrinkage after hardening especially about the high flow high-strength concrete which discovers the compressive strength of 70Ns/mm² or more.

[0002]

[Description of the Prior Art] The tendency of super-high-rise-izing of the viewpoint of much more effective use of land to a building or large-scale-izing is becoming still more remarkable in recent years. In the construction work of such a super-high-rise or large-scale building, the hi-performance concrete which is excellent in flowability and segregation resistance, and discovers high intensity (compressive strength of 70Ns/mm² or more) from viewpoints, such as shortening of a construction period, laborsaving of construction, and dissolution of a construction defect, is called for. Moreover, the hi-performance concrete which is excellent in flowability and segregation resistance, and discovers high intensity (compressive strength of 70Ns/mm² or more) from viewpoints, such as reduction of the noise by mechanical puddling, also at a precast concrete factory is called for.

[0003] The amount of cement in the hi-performance concrete usually called a thickener system and 2 concrete which uses conventionally the water soluble polymer which has 1 thickening operation as hi-performance concrete is increased. Hi-performance concrete ** which made water / cement ratio small using (for example, 500kg/m³ or more) and water reducing agents (a high-range water reducing agent, a high-performance AE water-reducing agent, etc.) (for example, 35 or less weight %) and which is usually called a fine-particles system is known.

[0004]

[Problem(s) to be Solved by the Invention] In the above-mentioned thickener system hi-performance concrete, in order to secure flowability, the amount of cement is [400-500kg/m³, and water / cement ratio] about 40 to 50 weight % in many cases. Therefore, it was difficult to discover the compressive strength of 70Ns/mm² or more in this thickener system hi-performance concrete. On the other hand, if the fine-particles system hi-performance concrete can be excellent in flowability and segregation resistance and could also make the high intensity of 70Ns/mm² or more discover, there was, but since it was one side, and there were many amounts of cement and water / cement ratio was small, the technical problem that the autogeneous shrinkage after hardening became large occurred. With concrete with such large autogeneous shrinkage, when it uses for RC member, big tensile stress occurs in a member inferior border part by the restraint of a steel rod, and it is pointed out, for example that evil may be caused dynamically.

[0005]

[Means for Solving the Problem] If the amount of weight loss from 20 degrees C by thermogravimetric measurement to 500 degrees C is the hi-performance concrete of the specific blending ratio of coal which uses cement which is a specific range, and a specific chemical admixture as a result of inquiring wholeheartedly, in order that this invention person etc. may solve the above-mentioned technical problem Even if it is 70Ns/mm² or more in compressive strength, it finds out that the amount of autogeneous shrinkage can be made small, and this invention is completed. Main minerals this invention Namely, a 3 CaO-SiO₂-2 CaO-SiO₂-CaO-interstitial material, They are a 3 CaO-SiO₂-CaO-interstitial material, a 2 CaO-SiO₂-CaO-interstitial material, or a CaO-interstitial material. And the chemical admixture which consists of the clinker constituent which contains a CaO crystal 50 to 92weight %, the preferential grinding thing of gypsum fibrosum or said clinker constituent, quicklime, and a preferential grinding thing with gypsum fibrosum, Cement whose amount of weight loss from 20 degrees C by thermogravimetric measurement to 500 degrees C is 0.7 to 2.5 weight %, They are a water reducing agent, a fine aggregate, coarse aggregate, and the high flow high-strength concrete (Claim 1) characterized by for 500-700kg/m³, and water / cement ratio being [for the total quantity of cement and a chemical admixture] 25 to 35 weight %, and a base-diameter-of-concrete-mass-after-the-slump-test value being 50-80cm including water. And as for the loadings of the above-mentioned chemical admixture, 1-60kg/m³ is desirable (Claim 2).

[0006]

[Embodiment of the Invention] This invention is explained in detail hereafter. The amount of weight loss from 20 degrees C according [the cement used by this invention] to thermogravimetric measurement to 500 degrees C is 1.0 to 2.2weight % of a thing preferably 0.7 to 2.5weight %. When the amount of weight loss by thermogravimetric measurement uses cement of said range, even if it is 70Ns/mm² or more in compressive strength, the amount of autogeneous shrinkage after hardening can be made small. Since it becomes difficult for the amount of weight loss from 20 degrees C by

thermogravimetric measurement to 500 degrees C to make small the amount of autogeneous shrinkage after hardening into less than 0.7weight % of cement, it is not desirable. Since it becomes difficult for hardness discovery nature to fall and to make the compressive strength of 70Ns/mm² or more discover into cement with the amount of weight loss of greater than 2.5 weight % from 20 degrees C by thermogravimetric measurement to 500 degrees C, it is not desirable. In addition, what is necessary is just to perform thermogravimetric measurement using a commercial apparatus for thermogravimetry. 10-20 degrees C / min of a heating rate are desirable.

[0007] [the amount of weight loss from 20 degrees C by said thermogravimetric measurement to 500 degrees C] as cement which is 0.7 to 2.5 weight % For example, the adding-water treatment cement which made water hold by spraying/or the steam which sprays water while usually carrying out [which is marketed] high-speed churning of the Portland cement, such as high-early-strength and moderate heat Portland cement, etc., When cement clinker and gypsum fibrosum are finished and a mill grinds, the cement ground while watering is mentioned.

[0008] Main minerals the chemical admixture used by this invention A 3 CaO-SiO₂-2 CaO-SiO₂-CaO-interstitial material, They are a 3 CaO-SiO₂-CaO-interstitial material, a 2 CaO-SiO₂-CaO-interstitial material, or a CaO-interstitial material. And it consists of the clinker constituent which contains a CaO crystal 50 to 92weight %, the preferential grinding thing of gypsum fibrosum or said clinker constituent, quicklime, and a preferential grinding thing with gypsum fibrosum.

[0009] The clinker constituent in a chemical admixture contains a CaO crystal and an interstitial material at least as a main mineral. The clinker constituent which does not need to be included although alite (3CaO-SiO₂) and/or belite (2CaO-SiO₂) are included is ground, and a CaO crystal is included 50 to 92weight %. By including a CaO crystal and an interstitial material at least as a main mineral, the effect which makes small autogeneous shrinkage of high flow high-strength concrete without spoiling workability is acquired. The effect that the CaO crystal in a clinker constituent makes small autogeneous shrinkage of high flow high-strength concrete at less than 50 weight % becomes small and is not desirable. Workability worsens and is not desirable if the CaO crystal in a clinker ground product exceeds 92 weight %. In addition, an interstitial material is similar to the mineral which fills between alite in a cement clinker mineral, or belite, and specifically Calcium aluminum NETO minerals, such as a calcium ferrite mineral of 2 CaO-Fe₂O₃ grade, and 3CaO, Al₂O₃, Or it is the calcium alumino ferrite mineral of 6CaO, Al₂O₃andFe₂O₃, 4CaO, Al₂O₃andFe₂O₃, 6CaO and 2 Al₂O₃, and Fe₂O₃ grade.

[0010] A clinker constituent mixes a calcareous raw material, a clay raw material, silica, slag, gypsum fibrosum, etc., and is manufactured by fully burning this raw material mixture and calcinating it in total until the mineral of a target clinker is obtained at the temperature of 1300-1600 degrees C with a rotary kiln etc.

[0011] Anhydrous gypsum is preferably good, although the kind of gypsum fibrosum in a chemical admixture is not limited and anhydrous gypsum, hemihydrate gypsum, and gypsum dihydrate can be used. When ** chemical admixture is the binary system of a clinker constituent and gypsum fibrosum, gypsum fibrosum 5 - 50 weight parts are suitable for the quantity of gypsum fibrosum in a chemical admixture to a clinker constituent 100 weight part. Moreover, when ** chemical admixture is the three-component system of a clinker constituent, quicklime, and gypsum fibrosum, gypsum fibrosum 5 - 50 weight parts are suitable to the total quantity 100 weight part of a clinker constituent and quicklime. If there are few loadings of gypsum fibrosum in a chemical admixture than said range, the effect which makes small autogeneous shrinkage of high flow high-strength concrete becomes small and is not

desirable. It is [concern from which high flow high-strength concrete causes the strength reduction by an expansion crack] and is not desirable if there are more loadings of gypsum fibrosum than said range. [0012] By blending quicklime with a chemical admixture, autogeneous shrinkage of high flow high-strength concrete can be made smaller. Although the kind of quicklime is not limited and quicklime, such as soft-burned lime, inside glow quicklime, hard-burned lime, and pole hard-burned lime, can be used It is desirable that the coarse grain titration test value by the coarse grain titration method of test by a Japanese lime association's 4N-hydrochloric acid uses 650ml or less of quicklime from workability, and it is more desirable to use 400ml or less of quicklime.

[0013] Less than 80 weight % of quicklime is [in / to a clinker constituent 100 weight part / under 400 weight parts, i.e., the total quantity of a clinker constituent and quicklime,] suitable for the loadings of quicklime in a chemical admixture. Workability worsens and is not desirable if there are more loadings of quicklime in a chemical admixture than said range.

[0014] Although a chemical admixture consists of the above-mentioned clinker constituent and the preferential grinding thing of gypsum fibrosum or the above-mentioned clinker constituent, quicklime, and a preferential grinding thing with gypsum fibrosum, what was mixed after grinding individually is sufficient as these, and what was ground after mixing is sufficient as it. Moreover, you may supply with other material what was ground individually to a mixer at the time of kneading of high flow high-strength concrete. Grinders, such as a ball mill and a roll mill, can be used for grinding. More than 3000cm²/g of the fineness of a chemical admixture is desirable at Blaine's specific surface area, and its 4000-8000cm²/g is more desirable. The effect that Blaine's specific surface area of a chemical admixture makes small autogeneous shrinkage of high flow high-strength concrete under by 3000cm²/g becomes small and is not desirable.

[0015] Material other than the cement used by this invention and a chemical admixture is explained. As a fine aggregate, river sand, an inland sand, sea sand, crushed sand, or these mixtures can be used. As coarse aggregate, a river gravel, a pit gravel, a sea gravel, crushed stones, or these mixtures can be used. As a water reducing agent, the water reducing agent of a lignin system, a naphthalene sulfonic acid system, a melamine system, and a polycarboxylic acid system, an AE water-reducing agent, a high-range water reducing agent, or a high-performance AE water-reducing agent can be used. It is desirable to use the large high-range water reducing agent or large high-performance AE water-reducing agent of a water-reducing effect in this invention. Tap water etc. can be used for water. In addition, in this invention, using admixture, such as an air entraining agent, a defoaming agent, and a thickener, blast-furnace-slag powder, fly ash, limestone powder, silica fume, etc. within convenient limits if needed does not interfere.

[0016] The total quantity of cement and a chemical admixture is [500-700kg/m³, and water / cement ratio] 25 to 35 weight %, and the high flow high-strength concrete of this invention is 50-80cm in base-diameter-of-concrete-mass-after-the-slump-test value. The compressive strength of 70Ns/mm² or more can be made to be able to discover, in excelling in flowability and segregation resistance, if it is the high flow high-strength concrete of said conditions, and the amount of autogeneous shrinkage after hardening can also be made small. In this invention, it becomes difficult and is not desirable that the total quantity of cement and a chemical admixture makes the compressive strength of 70Ns/mm² or more discover in less than 500kg/m³. If the total quantity of cement and a chemical admixture exceeds 700kg/m³, it becomes difficult and is not desirable to make small the amount of autogeneous shrinkage after hardening. Moreover, since it becomes difficult for a base-diameter-of-concrete-mass-after-the-slump-

test value to be set to less than 50cm, and for water / cement ratio to aim at shortening of a construction period, laborsaving of construction, dissolution of a construction defect, etc. in the construction work of a building at less than 25 weight %, for example, it is not desirable. If water / cement ratio exceeds 35 weight %, it becomes difficult and is not desirable to make the compressive strength of 70Ns/mm² or more discover. Moreover, a base-diameter-of-concrete-mass-after-the-slump-test value [less than 50cm] For example, moreover it becomes difficult to aim at shortening of a construction period, laborsaving of construction, dissolution of a construction defect, etc. in the construction work of a building, since it becomes difficult to aim at reduction of the noise by mechanical puddling also at a precast concrete factory, it is not desirable. If a base-diameter-of-concrete-mass-after-the-slump-test value exceeds 80cm, since segregation resistance will fall, it is not desirable.

[0017] In the high flow high-strength concrete of this invention, from a viewpoint of workability and autogeneous shrinkage reduction, as for the loadings of a chemical admixture, 1-60kg/m³ is desirable, and its 5-55kg/m³ is more desirable. The effect that the loadings of a chemical admixture make small autogeneous shrinkage of high flow high-strength concrete in less than 1kg/m³ becomes small and is not desirable. It is [concern from which high flow high-strength concrete causes the strength reduction by an expansion crack] and is not desirable in workability's worsening, if the loadings of a chemical admixture exceed 60kg/m³.

[0018] In the high flow high-strength concrete of this invention 500-700kg/m³ and the amount of chemical admixtures are [the total quantity of cement and a chemical admixture] desirable, and 1-60kg/m³, and water / cement ratio are 25 to 35 weight %. If a base-diameter-of-concrete-mass-after-the-slump-test value is 50-80cm, limit neither a water reducing agent / cement ratio nor unit coarse aggregate absolute volume in particular, but workability, cost, etc. of concrete are taken into consideration. As for a water reducing agent (solid content conversion) / cement ratio, it is desirable to make unit coarse aggregate absolute volume into 0.27-0.36m³/m³ 0.3 to 2.0weight %.

[0019] It is the conventional method and what is necessary is to limit neither the kneading method of the high flow high-strength concrete of this invention, nor kneading equipment in particular, and just to knead it by a conventional mixer. Moreover, the care-of-health method in particular is not limited, either, and what is necessary is just to perform atmospheric curing, underwater curing, steam curing, etc.

[0020]

[Example] A work example explains this invention hereafter.

1. The material shown below in use material was used.

1) Cement ** cement A; ordinary portland cement by Taiheiyo Cement Corp. was fed into the double spindle type kneader, and the adding-water treatment cement which carried out adding-water treatment was used with the supersonic humidifier, agitating. The amount of weight loss from 20 degrees C by the thermogravimetric measurement of this cement to 500 degrees C was 1.3 weight %.

** Cement B; ordinary portland cement by Taiheiyo Cement Corp. was used. The amount of weight loss from 20 degrees C by the thermogravimetric measurement of this cement to 500 degrees C was 0.6 weight %.

[0021] 2) it becomes the mineral composition which shows the preparation limestone, the silica, the clay, the iron raw material, and anhydrous gypsum of a chemical admixture ** clinker constituent in Table 1 -- as It mixed, and this mixture was burned with the rotary kiln in burning temperature [of 1300-1600 degrees C], and residence time 60 to 120 minutes, the clinker was manufactured in total, and this was ground to Blaine's specific surface area of 5000cm²/g.

[0022]

[Table 1]

CaO結晶 (重量%)	3CaO・SiO ₂ (重量%)	間隙物質* (重量%)
61.5	25.3	5.1

*2CaO・Fe₂O₃等

[0023] ** The preparation above-mentioned clinker constituent 100 weight part of a chemical admixture and the anhydrous gypsum (Blaine's specific surface area 6500cm²/g) 10 weight part were mixed, and the chemical admixture was prepared.

[0024] The material shown below was used as material other than cement and a chemical admixture.

3) High-performance AE water-reducing agent; REOBIRUDO SP-8S (Product made from NMB) were used.

4) Fine aggregate; the inland sand from SHIZUOKA PREFECTURE (specific gravity in saturated surface-dry condition: 2.60) was used.

5) Coarse aggregate; the crushed stone from Ibaragi Prefecture (specific gravity in saturated surface-dry condition: 2.64) was used.

6) Water; tap water was used.

[0025] 2. Combination of concrete and the kneading aforementioned material were used, and concrete was prepared according to the combination shown in Table 2. Kneading was kneaded for 180 seconds using the biaxial vertical shaft type mixer (0.06m³).

[0026]

[Table 2]

	コンクリートの配合 (kg/m ³)						
	セメント		混和材	細骨材	粗骨材	水	高性能AE 減水剤
	A	B					
実施例 1	573	—	10	794	832	175	7.58
実施例 2	563	—	20	794	832	175	7.58
実施例 3	553	—	30	794	832	175	7.58
実施例 4	533	—	50	794	832	175	7.58
比較例 1	583	—	—	794	832	175	7.58
比較例 2	—	583	—	794	832	175	7.58

[0027] 3. After pulling up a slump cone according to an evaluation 1 base-diameter-of-concrete-mass-after-the-slump-test value "JIS A 1101 (slump test method of concrete)", the average was computed by having measured the length and the length of the right-angled direction of the maximum diameter of spreading concrete, and the base-diameter-of-concrete-mass-after-the-slump-test value was calculated.

2) It fabricated after compressive strength kneading using the $\phi 10 \times 20$ cm mold. It recuperated itself and unmolded within the mold for one day after shaping. Then, underwater curing was carried out till age the 28th, and compressive strength was measured according to "JIS A 1108 (compressive strength test method of concrete)."

3) The amount of autogeneous shrinkage of the amount of autogeneous shrinkage above-mentioned concrete (age 28 days) was measured according to Japan Concrete Institute "autogeneous shrinkage test method of hi-performance concrete (tentative name)." In addition, measurement made initial setting time of coagulation group length. The result is shown in Table 3.

[0028]

[Table 3]

	スランプフロー (cm)	圧縮強度 (N/mm ²)	自己収縮量 ($\times 10^{-6}$)
実施例 1	6 4 . 5	8 5 . 4	- 2 3 5
実施例 2	6 4 . 0	8 7 . 0	- 1 0 5
実施例 3	6 4 . 0	8 6 . 2	4 9
実施例 4	6 1 . 5	8 3 . 3	3 3 5
比較例 1	6 3 . 5	8 4 . 9	- 3 9 5
比較例 2	6 2 . 0	9 0 . 1	- 5 4 0

[0029] Even if it was 70Ns/mm² or more in compressive strength in the high flow high-strength concrete specified by this invention so that clearly from Table 3, the amount of autogeneous shrinkage was small.

[0030]

[Effect of the Invention] As explained above, the high flow high-strength concrete of this invention can discover the compressive strength of 70Ns/mm² or more, and can make the amount of autogeneous shrinkage small. Therefore, in the construction work of a building, shortening of a construction period, laborsaving of construction, dissolution of a construction defect, etc. can be aimed at by using the high flow high-strength concrete of this invention, for example. Moreover, reduction of the noise by

mechanical puddling can be aimed at also at a precast concrete factory. Furthermore, when RC member is manufactured using the high flow high-strength concrete of this invention, there are few possibilities that dynamic evil will arise.

[Translation done.]